

**What is claimed is:**

1. A small form factor transceiver module, comprising:
  - a serial transfer interface for coupling an incoming serial data stream and an outgoing serial data stream with a host having a gigabit Ethernet (GE) data protocol;
  - a transceiver for coupling said incoming serial data stream and said outgoing serial data stream to a network having a time domain multiplexed (TDM) data protocol;
  - a protocol converter coupling said serial transfer interface and said transceiver, said protocol converter operative to convert an incoming TDM serial data stream received from said external network into a GE serial data stream for said host, said protocol converter also operative to convert an outgoing GE serial data stream received from said host into a TDM serial data stream for said external network;
  - wherein said transceiver module is operative as both a transceiver and as a protocol converter.
2. The module of claim 1, wherein said protocol converter is formed on an integrated circuit.
3. The module of claim 1, wherein said protocol converter comprises:
  - a first protocol converter disposed along a first data path associated with said incoming serial data stream, comprising:
    - a deserializer to deserialize a TDM serial data stream into a parallel TDM data stream;
    - a deframer for deframing said parallel TDM data stream;
    - a de-encapsulator to de-encapsulate said parallel data stream into a GE protocol; and
    - a serializer to convert a de-encapsulated parallel GE data stream into a serial GE data stream; and
  - a second protocol converter disposed along a second data path associated with said outgoing serial data stream, comprising:
    - a deserializer to deserialize a GE serial data stream to form a parallel GE data stream;
    - an encapsulator to encapsulate said parallel GE data stream into said TDM protocol;

a framer coupled to said encapsulator for generating TDM frames; and  
a serializer receiving an output of said framer to convert said parallel data stream into a serial TDM data stream.

4. The module of claim 1, wherein said TDM protocol is a TDM protocol selected from the group consisting of synchronous data hierarchy (SDH), synchronous optical network (SONET) and a plesiosynchronous data hierarchy (PDH).
5. The module of claim 1, further comprising: a controller adapted to communicate control information with said host via interband Ethernet frames exchanged with said host.
6. The module of claim 1, wherein said protocol converter comprises:  
a first SERDES for coupling data to said serial transfer interface;  
a Gigabit Ethernet PHY module coupled to exchanged data between said first SERDES and a MAC module;  
an encapsulation module coupled to said MAC to perform an encapsulation protocol selected from the group consisting of frame relay, HDLC, and GFP;  
a framer coupled to the output of said encapsulation module; and  
a second SERDES for coupling data between said framer and said transceiver.
7. The module of claim 6, further comprising: a controller coupled to said MAC, said controller adapted to communicate control information with said host via interband Ethernet frames exchanged on said host interface.
8. The module of claim 6, wherein said protocol converter is formed on an integrated circuit.
9. The module of claim 1, wherein said TDM protocol is a plesiosynchronous data hierarchy (PDH) protocol adapted for T1/E1 signals.
10. The module of claim 1, wherein said TDM protocol is a plesiosynchronous data hierarchy (PDH) protocol adapted for T3/E3 signals.
11. The module of claim 1, wherein said TDM protocol is a SONET protocol selected from the group consisting of OC-3/STM-1, OC-12/STM-4, and OC-48/STM-16.

12. The module of claim 1, wherein said first protocol converter is configured to perform protocol conversion including at least one member from the group consisting of: GFP mapping, POS/HDLC mapping, and frame relay mapping.

13. A system, comprising:

a router having a gigabit Ethernet (GE) data protocol; and

a small form factor interface converter transceiver module for coupling data between said router and a connection port of an external network having a time division multiplexed (TDM) data protocol, the transceiver module comprising:

a serial transfer interface module for coupling an incoming serial data stream and an outgoing serial data stream to a host having a gigabit Ethernet (GE) data protocol;

a transceiver for coupling said incoming serial data stream and said outgoing serial data stream to a network having a time domain multiplexed multiplexed (TDM) data protocol; and

a protocol converter coupling said serial transfer interface and said transceiver, said protocol converter operative to convert an incoming TDM serial data stream received from said external network into a GE serial data stream for said host,

said protocol converter also operative to convert an outgoing GE serial data stream received from said host into a TDM serial data stream for said external network.

14. The system of claim 13, wherein said protocol converter comprises:

a first SERDES for coupling data to said serial transfer interface;

a Gigabit Ethernet PHY module coupled to exchanged data between said first SERDES and a MAC module;

an encapsulation module coupled to said MAC to perform an encapsulation protocol selected from the group consisting of frame relay, HDLC, and GFP;

a framer coupled to the output of said encapsulation module; and

a second SERDES for coupling data between said framer and said transceiver.

15. The system of claim 14, further comprising: a controller coupled to said MAC, said controller adapted to communicate control information with said host via interband Ethernet frames exchanged on said host interface.

16. A method of protocol conversion using a small form factor transceiver module for coupling a serial data stream between a router and an external network, comprising:

within said module, converting a Gigabit Ethernet data protocol of a serial data stream received from said router into a time division multiplexed (TDM) protocol of said external network prior to transmitting said serial data stream to said external network; and

within said module, converting said TDM protocol of a serial data stream received from said external network into said Gigabit Ethernet data protocol prior to transmitting said serial data stream to said router;

wherein said module is operative as both a transceiver and as a protocol converter.

17. The method of claim 16, further comprising:

at said module, receiving at least one in-band Ethernet frame embedded within said serial data stream received from said router; and

identifying at least one command from said router contained within said at least one in-band Ethernet frame.

18. The method of claim 16, further comprising:

at said module, forming a message to said router; and

embedding said message in an in-band Ethernet frame transmitted in said serial data stream transmitted to said router.

19. The method of claim 16, wherein said module is capable of performing protocol conversion for a plurality of TDM data protocols, further comprising:

configuring said module to perform protocol conversion for a selected TDM data protocol.

20. The method of claim 16, further comprising:

performing Ethernet flow control to match a data rate of said router and said external network.

21. The method of claim 16, wherein said TDM protocol is a SONET protocol, the method further comprising:  
using an optical transceiver to couple SONET signals to an optical fiber interface.
22. The method of claim 16, wherein said TDM protocol is a PDH protocol, the method further comprising:  
using an analog front end to couple PDH signals to copper cables.